Subsystem Checkpoint Restart
Atlas Delivery DP1

Checkout and Launch Control System (CLCS)

84K00303-019

Approval:

_____
Chief, System Engineering   Date
and Integration Division

NOTE: See "**Supporting Document Note**" on following page

PREPARED BY: Darrell J. Bushard
_____

_____

_____

_____

_____

_____

_____

Supporting Document Note:

Acronyms and definitions of many common CLCS terms may be found in the following documents: CLCS Acronyms 84K00240 and CLCS Project Glossary 84K00250.

i

REVISION HISTORY

REV	DESCRIPTION	DATE
Draft Basic	Final draft of Atlas Subsystem Checkpoint Restart DP1 Promoted by design panel approval per Paula Holbrook	4/23/98 4/29/98

LIST OF EFFECTIVE PAGES

Dates of issue of change pages are:

Page No.	A or D*	Issue or Change No.	CR No.	Effective Date**

Table of Contents

Assessment Team

Name	CI Represented	Phone
Darrell Bushard (ATL)	Systems Engineering	1-7833
Shawn Quinn	Gateway Subsystems	1-9065
Brian Bateman	DDP Subsystem	1-9075
Jack Blackledge	CCP Subsystem	1-9078
Debbie Lee	CCWS Subsystem	1-9084
Steve Moore	System Control	1-9203
Ken Castner	Redundancy Management	1-9020
Walter Clavette	Command Support	1-9027
Doug Hammond	Command & Control	1-9027
Jack Raucci	Data Distribution & Processing	1-9021
Chau Le	PCM Gateway	1-2293
Van Bullington	LDB Gateway	1-2292
Mike Lunceford	GSE Gateway	1-2294
Justin Beaver	Common Gateway Services	1-7683

1. INTRODUCTION

1.1 SUBSYSTEM CHECKPOINT RESTART OVERVIEW

This thread provides the capability to save and, subsequently, restore RTPS runtime state. The Atlas delivery provides phase 1 of the Subsystem Checkpoint Restart thread phases, addressing the need to rapidly return GSE gateway runtime tables to their state at specific points previously visited in the processing flow supported by a single CLCS TCID.

1.2 SUBSYSTEM CHECKPOINT RESTART CONCEPT

1.2.1 Subsystem View

At the RTPS subsystem level, checkpointing is the process of saving information in subsystem runtime tables that reflects the state of the subsystem at a specific point in the CLCS processing flow, relative to a system synchronous rate event. In general, the information that must be saved is that information originally obtained from TCID tables which can be changed during runtime because of table maintenance commands. Once saved, this information is referred to as a subsystem checkpoint. The subsystem checkpoint can then be used to restart the subsystem, or a subsystem of the same type, in the state it was in at the time of the checkpoint.

1.2.1.1 Subsystem Checkpoint Timeline

The timelines shown in figure 1.2.1.1 indicate when GSE gateway checkpoint and load from checkpoint actions can occur, relative to other subsystem events. The first timeline shows GSE gateway A able to process a command to checkpoint tables (Checkpoint x, Checkpoint y) after TCID load, anytime before or after data acquisition is activated (i.e., anytime while in GO or NOGO mode). It also shows that the gateway will accept a command to load checkpoint tables (Load Checkpoint x) only while in NOGO mode (i.e., data acquisition inhibited). The second timeline shows that GSE gateway B will accept a command to load a checkpoint taken on GSE gateway A (Load Checkpoint y) anytime while in NOGO mode, but only after initial TCID load with the same TCID that was loaded on gateway A when the checkpoint was taken (TCID a). To support the capability to load one subsystem with a checkpoint generated from another subsystem of the same type, a subsystem checkpoint does not contain any RTPS physical hardware configuration information. RTPS functional assignments to physical hardware platforms must be known to any subsystem prior to TCID load and initialization from baseline or checkpoint.
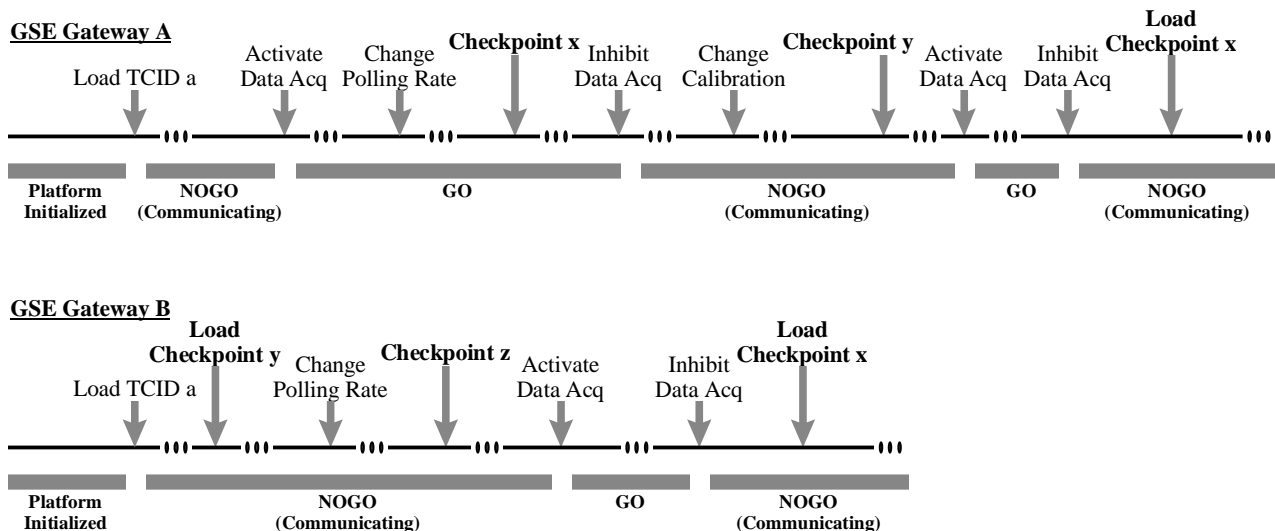

Figure 1.2.1.1 - Checkpoint/Restart Timeline (Phase 1)

1.2.1.2 Subsystem Checkpoint Function

The GSE gateway checkpoint generation function is illustrated in Figure 1.2.1.2. When a checkpoint command is received from the Test Set Master CCP (1), it is routed to GSE Table Load (2). GSE Table Load creates a checkpoint dataset entry on local disk (3), and invokes the checkpoint tables method of local CSCs having TCID tables that can be changed during runtime (4), to append the contents of those tables to the checkpoint dataset entry.
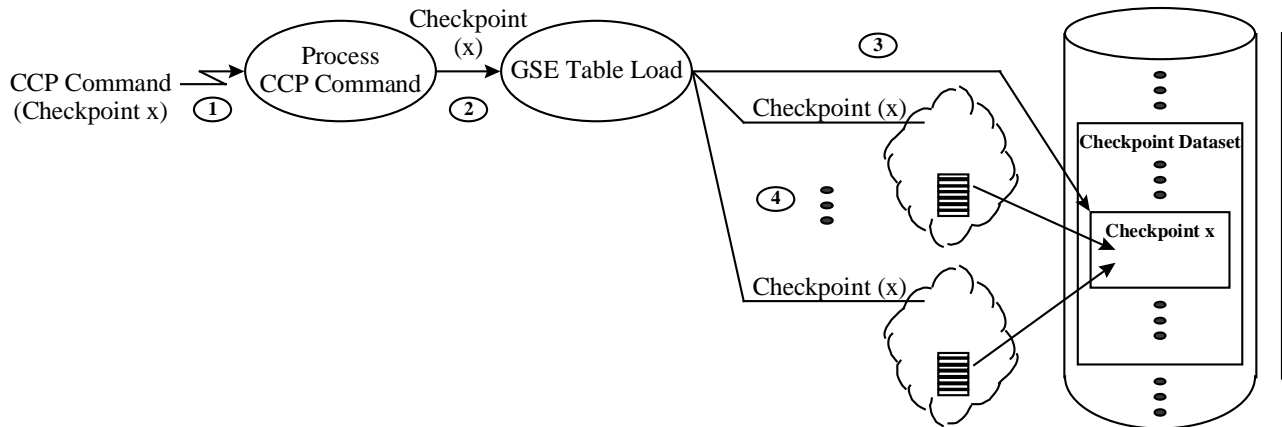
Figure 1.2.1.2 - GSE Gateway Checkpoint Function

1.2.1.3 Subsystem Restart Function

The GSE gateway restart from checkpoint function is illustrated in Figure 1.2.1.3. When a load from checkpoint command is received from the Test Set Master CCP (1), it is routed to GSE Table Load (2). GSE Table Load invokes the restart method of local CSCs having TCID tables that can be changed during runtime (3), to reinitialize runtime tables from the specified checkpoint dataset entry.
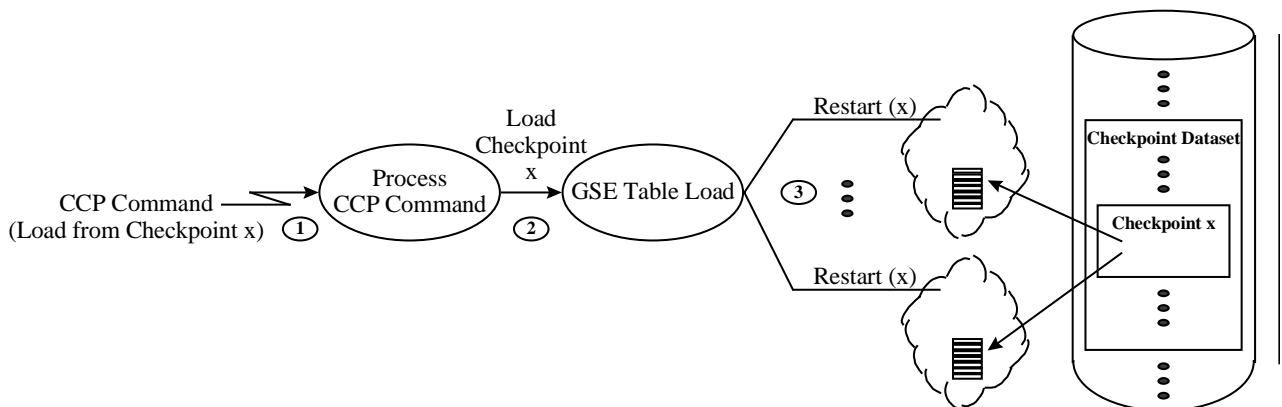
Figure 1.2.1.3 - GSE Gateway Restart Function

1.2.1.4 Subsystem Runtime Table States

Figure 1.2.1.4 shows the 4 CSC runtime table states and the operations that cause state transitions. Once the runtime table is initialized from either baseline TCID information, or a checkpoint, it is considered recoverable, because it can be reloaded from the baseline or checkpoint. When the CSC modifies the runtime table to satisfy one or more runtime table maintenance requests, the runtime table is no longer recoverable without satisfying the same runtime table maintenance requests. The runtime table becomes recoverable again when it is checkpointed, but, while checkpointing

runtime tables, a CSC must block runtime table maintenance commands long enough to ensure that the tables are not changing while checkpoint data is being extracted from them. Figure 1.2.1.4 shows this as a transition to the blocked state, followed by transition to the recoverable state once a snapshot of runtime table checkpoint data has been completed   This blocking of runtime table maintenance commands to complete a checkpoint must not affect the RTPS subsystem's capability to satisfy system performance requirements that limit runtime table maintenance command turnaround time.
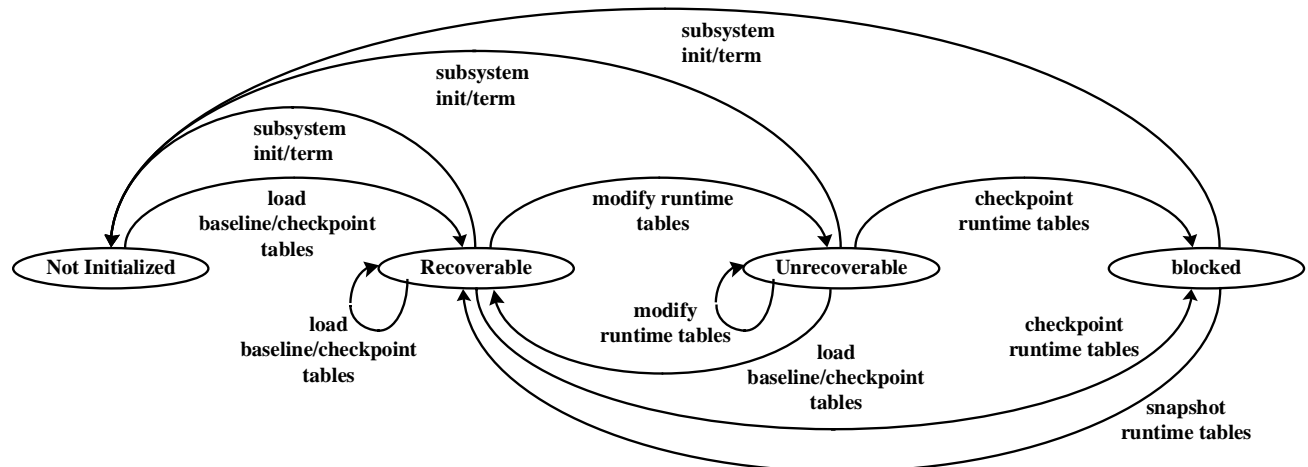
Figure 1.2.1.4 - CSC Runtime Table State Transitions

1.2.2 System View

1.2.2.1 System Checkpoint Function

Figure 1.2.2.1 is a system interface diagram for the System Checkpoint Function (phase 1). The System Checkpoint Viewer provides the user interface for the System Checkpoint Application, which runs in the Test Set Master CCP. The System Checkpoint Application establishes subsystem checkpoints by sending a checkpoint runtime command to the Subsystem Checkpoint Function in all, or a specified subset, of GSE gateways in the test set. Upon receipt of the checkpoint command, GSE Table Load creates an entry in the checkpoint dataset, invokes the checkpoint method of applicable GSE gateway CSCs to save checkpoint data in the checkpoint dataset entry, and sends a checkpoint success/fail response back to the System Checkpoint Application.

Figure 1.2.2.1 - System Checkpoint Function Interfaces (Phase 1)

1.2.2.2 Checkpoint Dataset Collection & Distribution

Subsystem checkpoints have a one-to-one correspondence to the test set TCID that was loaded when the checkpoint was established, and like the TCID, are portable across CLCS test sets. To support portability of checkpoints with the test set TCID, OPS CM provides the capability to collect subsystem checkpoints and store them on the test set local CM Server with the test set TCID.
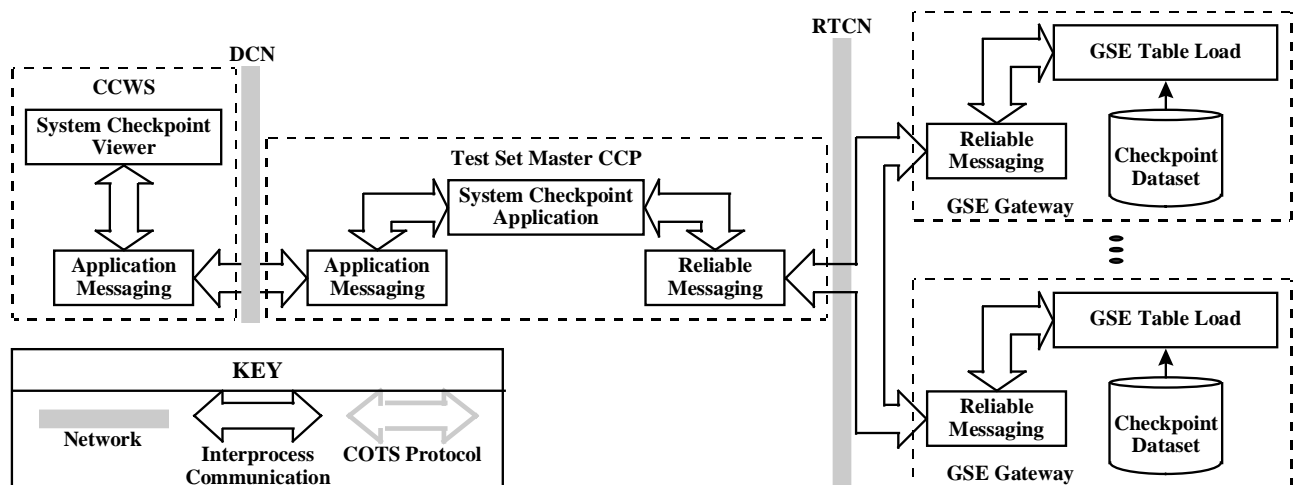
Figure 1.2.2.2.1 is a system interface diagram for GSE gateway checkpoint dataset collection. The System Checkpoint Application, running in the Test Set Master CCP, has an interface to OPS CM to support an option to initiate OPS CM checkpoint dataset collection automatically after generation of a checkpoint. In addition, checkpoint dataset collection can be initiated from the OPS CM Control Panel, running in the Test Set Master CCWS. In either case, collection occurs in the background, under OPS CM control, using subsystem platform services and COTS communication protocols.

Figure 1.2.2.2.1 - Checkpoint Dataset Collection Interfaces (Phase 1)

Previously collected subsystem checkpoints attached to a particular TCID can be retrieved by OPS CM from the local CM Server and distributed with other TCID information to GSE gateways as part of subsystem SCID/TCID load. Figure 1.2.2.2.2 is a system interface diagram for checkpoint dataset distribution. Like distribution of other TCID information, checkpoint dataset distribution is initiated from the OPS CM Control Panel, and occurs in the background, under OPS CM control, using subsystem platform services and COTS communication protocols.

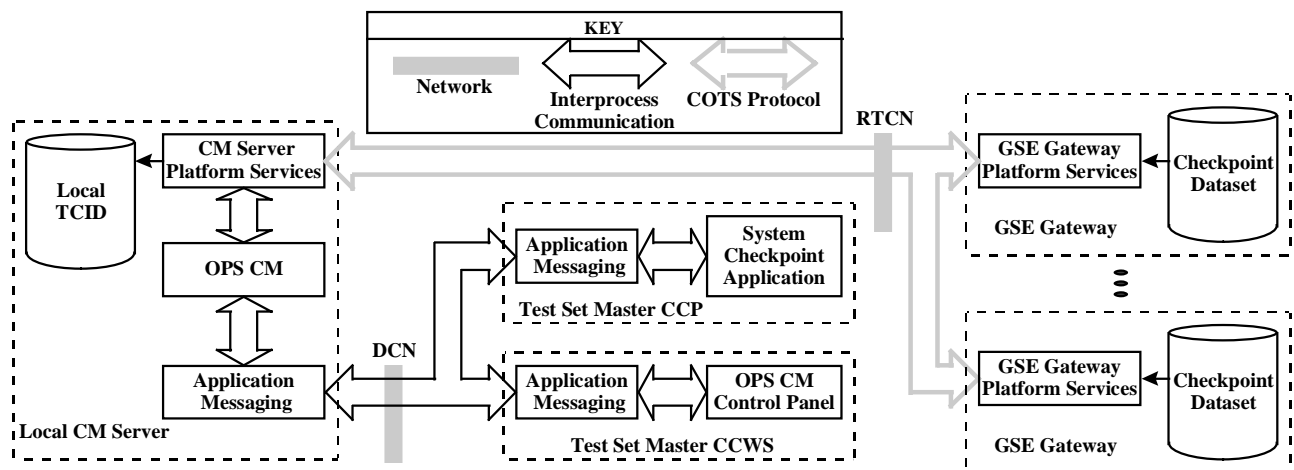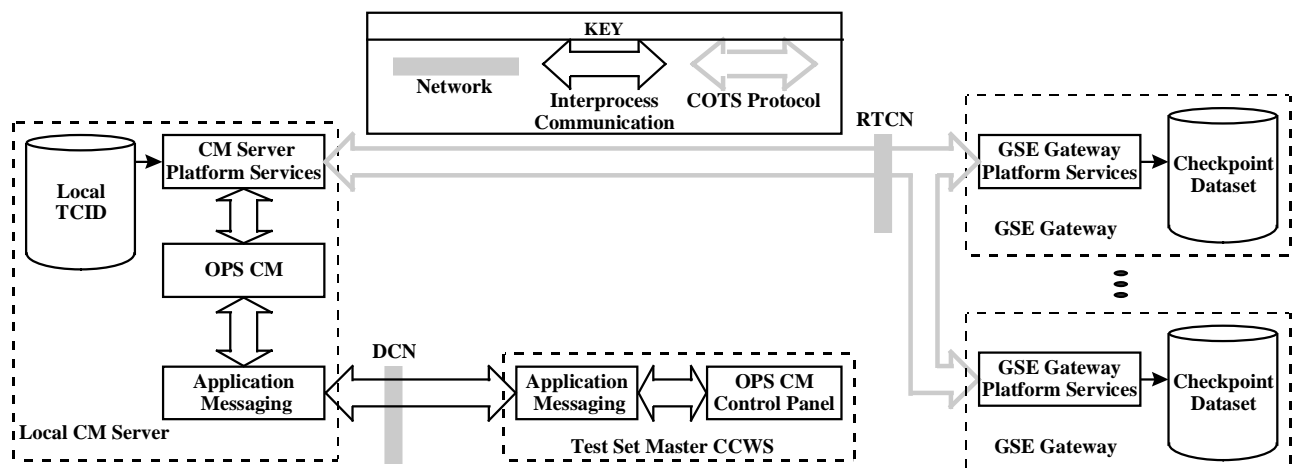**Figure 1.2.2.2.2 - Checkpoint Dataset Distribution Interfaces (Phase 1)**

1.2.2.3 Test Load & Initialization from Checkpoint

The OPS CM Test Load and Initialization function provides an option to load all or a specified subset of GSE gateways in the test set from a previously established checkpoint, rather than from the baseline TCID. As shown in figure 1.2.2.3, the system interfaces for checkpoint data loading are identical to those for baseline TCID loading, except that runtime tables are initialized from the subsystem's checkpoint dataset.
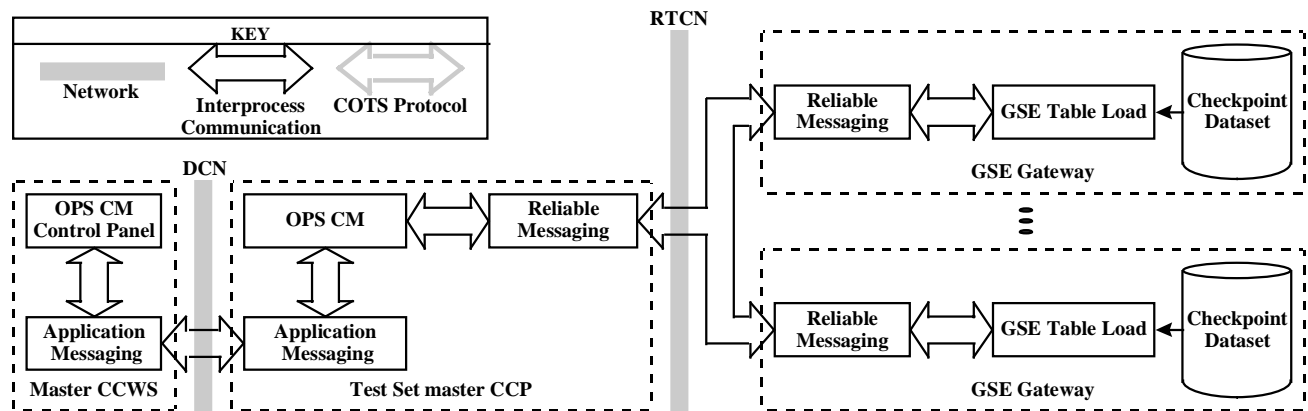

Figure 1.2.2.3 - Checkpoint Data Load Interfaces (Phase 1)

1.3 SUBSYSTEM CHECKPOINT RESTART OPERATIONAL AND FUNCTIONAL OVERVIEW

Operationally, the GSE Gateway Checkpoint Restart capability can be used to rapidly restore GSE gateways to a previously visited point in a CLCS processing flow. It is an alternative to reloading them from the baseline TCID and proceeding to the desired point by repeating the processing flow up to that point. Although most efficient use comes from analysis, beforehand, of anticipated processing flow to identify desired checkpoints and define the appropriate operational steps to create them, GSE gateway Checkpoint Restart supports creation of checkpoints on demand, anytime after GSE gateways are loaded and initialized. Load and initialization of GSE gateways from a previously created checkpoint, thus restoring a previously visited state, is done as an alternative to load and initialization from the baseline TCID.

1.3.1 System Checkpoint Application & Viewer

The system checkpoint application, executed on the Test Set Master CCP, and its system checkpoint viewer, running on the Test Set Master CCWS, provide the capability to establish checkpoints and display GSE gateway checkpoint status.

For each configured GSE gateway, the checkpoint status display indicates whether the gateway is loaded, whether it is loaded with baseline or checkpoint tables, the status of the last checkpoint attempted or the checkpoint currently in work, and a list of previously specified but pending checkpoints. More detailed information is optionally available, such as identification of loaded checkpoint tables, identification of checkpoints available on a subsystem, detailed error information on failed checkpoint attempts, and detailed information on pending checkpoints.

To establish a checkpoint, the system checkpoint application requires identification of checkpoint by name, selection of either checkpoint all GSE gateways or selected gateways, specification of the time the checkpoint is to occur, and specification of whether or not checkpoint data is to be automatically collected after completion of the checkpoint and attached to the test set TCID. At the appropriate time, the system checkpoint application issues checkpoint requests to the appropriate gateways and monitors checkpoint progress. When the checkpoint is complete, and automatic checkpoint data collection is specified, the system checkpoint application issues a command to OPS CM to carry out the checkpoint dataset collection.

The system checkpoint application can optionally be initiated with a script specifying desired actions to preclude runtime interaction.

1.3.2 Checkpoint Dataset Collection & Distribution

When checkpoint data is not automatically collected from GSE gateways after completion of a checkpoint, it can be collected from the OPS CM control panel on the Test Set Master CCWS. The OPS CM control panel also provides the capability to retrieve previously collected checkpoint datasets and distribute them to appropriate gateways.

To collect GSE gateway checkpoint datasets, specification of collect from all gateways or collect from selected gateways is required. Datasets are collected and attached to the test set TCID on the test set CM Server.

To distribute subsystem checkpoint datasets from the test set CM Server TCID, specification of distribute to all GSE gateways or distribute to selected gateways is required.

1.3.3 Restart from Checkpoint

The OPS CM control panel Test Load and Initialization function provides the capability to load GSE gateways from a checkpoint, rather than from the baseline TCID. For each GSE gateway selected for test load and initialization, selection of whether the gateway should be loaded and initialized to the baseline TCID or a specified checkpoint is required.

1.4 SUBSYSTEM CHECKPOINT RESTART SPECIFICATION

1.4.1 Statement of Work

Analyze the SLS and "Other Requirements" that are included and provide an assessment in DP1 of:
- Whether the requirement is incorporated into the Atlas release,
- The level of maturity the requirement will achieve in Atlas
    - Low = function only implemented in one subsystem,
    - Medium = function implemented in multiple CSCIs/Subsystems, but capability not available across the entire system,
    - High = function is implemented nearly everywhere, or
    - Complete = function is implemented everywhere that it is needed
- If the requirement will have to be verified for HMF to be declared operational

Provide Checkpoint Functions:
- Save current table images (GSE Gateways only)
- *Enable/Disable transaction recording (Phase TBD)*
- Restore saved table image (GSE Gateways only)
- *Applied Transaction updates (Phase TBD)*
- *Store table images to Shuttle Data Center (Phase TBD)*
- *Retrieve table images from Shuttle Data Center (Phase TBD)*
- *Update Current Value Table (Phase TBD)*
- *Synchronize to master tables (Phase TBD)*
- *Display checkpoint table images (Phase TBD)*
- *Edit checkpoint table images (Phase TBD)*

Provide the capability to record table updates against saved baseline images in real-time. (Phase TBD)
Provide the capability to apply transaction updates after loading baseline images. (Phase TBD)
Provide the capability to save local images to the Shuttle Data Center. (Phase TBD)
Provide the capability to load images from the Shuttle Data Center. (Phase TBD)
Provide GUI to perform Checkpoint Functions. (GSE Gateways only)
Provide APIs to perform Checkpoint Function. (Phase TBD)
Provide capability to provide a formatted display of all Checkpoint Tables. (Phase TBD)
Provide capability to edit select fields in Checkpoint Tables. (Phase TBD)
Develop design for Persistent Data. (Phase TBD)

1.4.1.1 Gateways All

Provide the capability to save individually, by name, images to local disk of the:
- Polling Tables (GSE Gateways only)
- *Format Tables. (Phase TBD)*
- Measurement Description (GSE Gateways only)
- Calibration coefficients (GSE Gateways only)

Provide the capability to load an image individually, by name, from local disk of the:
- Polling Table (GSE Gateways only)
- *Format Tables(Phase TBD)*
- Measurement Description (GSE Gateways only)
- Calibration Coefficients (GSE Gateways only)

1.4.1.2 Gateways Ground Support Equipment

Provide the capability to scan all HIM outputs to update command output status table.
Provide the capability to scan all HIM outputs to confirm that they are the same as current commanded state.
Provide the capability to scan all polling table HIM inputs to update current value tables.
Provide the capability to output, on demand to the Real-Time Critical Network all polling table HIM inputs values. (Phase TBD)

1.4.1.3 Gateways PCM

Provide the capability to output, on demand to the Real-Time Critical Network, values of all FDs in the current format. (Phase TBD)

1.4.1.4 Data Distribution Processor

Provide the capability to save individually by name images to local disk of the: (Phase TBD)
- *On-Line Databank*
- *Current Value Table (no real-time update)*
- *Constraint Tables*
- *Authentication Table*

Provide the capability to load an image individually by name from local disk of the: (Phase TBD)
- *On-Line Databank*
- *Current Value Table*
- *Constraint Tables*
- *Authentication Table*

Provide the capability to output one time on the Real-Time Critical Network and Display and Command Network values of all derived FDs. (Phase TBD)
Provide the capability to derive current value table from Shuttle Data Center recorded data. (Phase TBD)

1.4.1.5 Command and Control Processor

Provide the capability to save, individually by name, images to local disk of the: *(Phase TBD)*
- *On-Line Databank*
- *Current Value Table (no real-time update)*
- Application Set Load

Provide the capability to load an image, individually by name, from local disk of the: *(Phase TBD)*
- *On-Line Databank*
- *Current Value Table*
- Application Set Load

Provide the capability to output, on demand to the Real-Time Critical Network values of all local derived FDs. *(Phase TBD)*
Provide the capability to update the On-Line Data Bank from the Data Distribution Processor. *(Phase TBD)*

1.4.1.6 Command and Control Workstation

Provide the capability to save, individually by name images, to local disk of the: (Phase TBD)
- *On-Line Databank*
- *Current Value Table (no real-time update)*
- *Display Set Loads*
- *Plot Setup*
- *Constraint Viewer Setup*
- *FD Viewer Setup*
- *Message Viewer Setup*

Provide the capability to update On-Line Data Bank from the Data Distribution Processor. (Phase TBD)

1.4.2 Requirements

1.4.2.1 Requirements from SLS

1.4.2.1.1 Implementation

[2.2.3.3.1]   The CLCS shall provide the capability to issue all keyboard commands in Appendix B with a Y in the column titled "IMPL" (implement). [Complete]

[2.2.4.1.1]   The CLCS shall provide, using a Graphical User Interface (GUI) paradigm, the capabilities identified in Appendix B with a Y in the column titled "IMPL" (implement). [Complete]

[2.2.9.3.14]   After a "warm boot", the RTPS shall be capable of restoring to a checkpointed function. [Partial]

[2.2.9.3.15]   The RTPS shall provide a method to store current configuration data. (Partial)

[2.2.9.3.17]   The RTPS shall provide a method to restore previously stored configuration data. (Partial)

1.4.2.1.2 Performance

[2.2.2.4.2]   The time required to load a launch configuration Test Set shall not exceed 2 hours. [Reference]

[2.2.2.4.3]   A loaded and initialized Launch Configuration Test Set shall take less than 5 minutes to be activated. [Reference]

[2.2.2.4.4]   The time required to reconfigure a Launch Configuration Test Set to a new Test shall not exceed 15 minutes, assuming the new Test was previously loaded. [Reference]

[2.2.2.4.5]   The time required to reconfigure a failed Subsystem to an operational state, including configuration verification, shall not exceed 15 minutes assuming all software is already loaded on local disk. [Reference]

1.4.2.2 Other System Requirements

[4.9.4]   *The system shall provide a method for logging persistent FD information. (Phase TBD)*

[4.9.5]   *The system shall provide a method for initializing, updating, and reading persistent storage structures. (Phase TBD)*

1.4.2.3 Derived Requirements

1.4.2.3.1 Common Gateway Services CSCI

1.4.2.3.1.1   Common Gateway Services shall define an area on GSE gateway local disk, referred to as the checkpoint dataset, for storage of multiple checkpoints, which is read/write accessible to OPS CM.

1.4.2.3.2 GSE Gateways CSCI

1.4.2.3.2.1   GSE gateways shall provide the capability, on demand and when in Ready or Go mode, to save runtime table information at a specified time (relative to a system synchronous rate event) by specified name, referred to as a checkpoint, in such a way that the saved runtime information can be loaded on the same subsystem, or another subsystem of the same type, when data acquisition is inhibited, to initialize subsystem runtime tables to the state they were in when the checkpoint was made.

1.4.2.3.2.2 When saving runtime table information for a checkpoint, GSE gateways shall ensure subsystem runtime tables are not changing while checkpoint data is being extracted from them by blocking subsystem table maintenance commands, if necessary, but this blocking of runtime table maintenance commands to complete a checkpoint shall not affect the gateway's capability to satisfy system performance requirements that limit runtime table maintenance command turnaround time.

1.4.2.3.2.3 GSE gateways shall provide the capability, anytime data acquisition is inhibited, to use a named checkpoint resident on local disk to initialize subsystem runtime tables to the state they were in when the checkpoint was made, including gateway synchronization to physical interfaces, and synchronization of RTPS current value tables (CVTs).

1.4.2.3.2.4 GSE gateways shall store checkpoints by specified name in an area on local disk, referred to as the checkpoint dataset, which is predefined for storage of multiple checkpoints by Common Gateway Services .

1.4.2.3.3 RTPS System Control CSCI

1.4.2.3.3.1 Redundancy Management System Checkpoint Function shall provide the capability, through a graphical user interface, to command all or any subset of configured GSE gateways in Ready or Go mode to generate a checkpoint with a specified name at a specified time (relative to a system synchronous rate event).

1.4.2.3.3.2 Redundancy Management System Checkpoint Function shall provide the capability to command OPS CM to collect checkpoints, by specified checkpoint name, immediately after successful GSE gateway checkpoint generation; this capability shall be optional, with automatic collection the default, under user control from the graphical user interface.

1.4.2.3.3.3 Redundancy Management System Checkpoint Function shall provide the capability, through a graphical user interface, to display checkpoint status for each configured GSE gateway, including whether the gateway is loaded, whether it is loaded with baseline or checkpoint tables, the status of the last checkpoint attempted or the checkpoint currently in work, and a list of previously specified but pending checkpoints, with more detailed information optionally available, such as identification of loaded checkpoint tables, identification of checkpoints available on a gateway, detailed error information on failed checkpoint attempts, and detailed information on pending checkpoints.

1.4.2.3.3.4 OPS CM shall provide the capability to collect checkpoints from configured GSE gateways and attach them to the TCID on the test set local CM server.

1.4.2.3.3.5 OPS CM shall provide the capability to distribute checkpoints attached to the TCID on a test set local CM server to configured GSE gateway checkpoint datasets.

1.4.2.3.3.6 OPS CM shall provide the capability to command all or a specified subset of configured GSE gateways whose data acquisition is inhibited to use a named checkpoint resident on local disk to initialize subsystem runtime tables to the state they were in when the checkpoint was made.

1.4.2.3.4 RTPS System Viewers CSCI

1.4.2.3.4.1 System Checkpoint Viewer shall provide the graphical user interface to the Redundancy Management System Checkpoint Function for GSE gateway checkpoint generation, collection, and status display.

1.4.3 Other Considerations

1.4.3.1 Transaction Logs

Since there is no requirement to restore the RTPS to a previously visited, but uncheckpointed state for HMF, Subsystem Checkpoint Restart for the Atlas delivery (phase 1) does not address the concept of using transaction logs to automatically bring subsystems from checkpointed states to uncheckpointed states. The need for this requirement will be revisited in a subsequent phase.

1.4.3.2 Persistent Data

The handling of RTPS data that requires monitoring and tracking across CLCS processing flows defined by TCIDs (i.e., persistent data) is not addressed in Subsystem Checkpoint Restart for the Atlas delivery (phase 1). It will be addressed in a subsequent phase.

1.4.3.3 Application Program Interface

An application program interface that provides control and feedback for subsystem checkpoint generation is not required for phase 1 of Subsystem Checkpoint Restart. The need for this requirement will be revisited in a subsequent phase.

1.5 SUBSYSTEM CHECKPOINT RESTART HARDWARE DIAGRAM

Not applicable.

1.6 SUBSYSTEM CHECKPOINT RESTART DELIVERABLES

1.6.1 Software

Deliverable	R&D Document	Code	API Manual	Users Guide
OPS CM				
Redundancy Management				
System Status Viewer	New		N/A	New
GSE Table Load CSC	2 pages	200	N/A	2 pages

1.6.2 Hardware

Not applicable.

1.6.3 Interface Description Document

IDD Name	Responsible CI	Supporting CI
Subsystem Checkpoint Viewer API	System Control	System Viewers
Common Gateway Services to Ops CM	System Control	Common Gateway Services
RTPS C-to-C	Redundancy Management	GSE Gateways

1.7 SUBSYSTEM CHECKPOINT RESTART ASSESSMENT SUMMARY

1.7.1 Labor Assessments

No.	CSCI/HWCI Name	Atlas LM	Changes covered in
1	OPS CM		
	Redundancy Management	6.50	
2	System Viewers	6.00	
3	Common Gateway Services	0.05	
4	GSE Gateway Services	1.50	
	TOTAL	14.05	

1.7.2 Hardware Costs

Not applicable.

1.7.3 Subsystem Checkpoint Restart Procurement

Not applicable.

1.8 SUBSYSTEM CHECKPOINT RESTART SCHEDULE & DEPENDENCIES

1.8.1 Schedule

Task Name	Start	Finish
Atlas Assessment Kickoff	2/13/98	2/13/98
Concept Panel Internal Review	3/11/98	3/11/98
Concept Panel	3/13/98	
Atlas Development		
Requirement Panel Internal Review		
Requirement Panel		
Design Panel Internal Review		
Design Panel		
CSCI Unit Testing		
Development Integration Test		
CSCI Integration Test		
Support System Integration Test		
Atlas Development Complete		

1.8.2 Dependencies

No.	Dependency Area	Dependency	Need Date

1.9 SUBSYSTEM CHECKPOINT RESTART SIMULATION REQUIREMENTS

TBD.

1.10 SUBSYSTEM CHECKPOINT RESTART INTEGRATION AND SYSTEM TEST PLAN

TBD.

1.11 SUBSYSTEM CHECKPOINT RESTART TRAINING REQUIREMENTS

1.11.1 Training Needed

TBD.

1.11.2 Training to be provided

TBD.

1.12 SUBSYSTEM CHECKPOINT RESTART FACILITIES REQUIREMENTS

None.

1.13 SUBSYSTEM CHECKPOINT RESTART TRAVEL REQUIREMENTS

None.

1.14 SUBSYSTEM CHECKPOINT RESTART ACTION ITEMS/RESOLUTION

- ATL
    - Complete schedule and dependencies.
    - Complete Integration and System Test Plan, Simulation Requirements, Training Requirements.

2.   SUBSYSTEM CHECKPOINT RESTART ASSESSMENTS

2.1 SYSTEM CONTROL CSCI ASSESSMENT

OPS CM Work Required

TBD.

Redundancy Management Work Required

Development of the Subsystem/System Checkpoint Application. Includes receiving/distributing commands to the GSE gateways, and notifying subsystem software of need for checkpoint.

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
OPS CM	TBD	
Redundancy Management	6.5 LM	

Basis of estimate

None.

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation		
Users Guide		
API Interface Document		
Interface Design Document		
Test Procedure		

Assumptions

None.

Open Issues

None.

COTS Product Dependency List

None.

2.2 SYSTEM VIEWERS CSCI ASSESSMENT

Checkpoint Viewer Work Required

The Checkpoint Viewer will provide the capability to establish checkpoints and display subsystem checkpoint status for subsystems.

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
System Status Viewer	6 LM	

Basis of estimate

None.

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation	New	TBD
Users Guide	New	TBD
API Interface Document	N/A	N/A
Interface Design Document	New	TBD
Test Procedure	New	TBD

Assumptions

All needed information for the Checkpoint Viewer will be provided by APIs from Application Services.

Open Issues

None.

COTS Product Dependency List

Product Name	Quantity Needed	Need Date
Java	N/A	N/A

2.3 COMMON GATEWAY SERVICES CSCI ASSESSMENT

Common Gateway Services will need to provide a file structure on the GSE gateway Disk to save a Checkpoint at any time that the gateway is Operational. Also, the checkpoint will need to be accessible by Ops CM *when the gateway is in a Non-operational mode*.

Gateway Utility Services CSC Work Required

Negotiate a file structure with Ops CM within the current GSE gateway file structure to save and retrieve Checkpoints.

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
Gateway Utility Services CSC	0.05	0.55

Basis of estimate

This is an estimate of the time it will take to negotiate a file structure.

2-13

Documentation

The Common Gateway Services CSCI to System Control CSCI Ops CM CSC IDD will need to be updated to reflect the changes in the Gateway Disk file structure.

Document Type	New/Update	Number of Pages
Common Gateway Services CSCI to Ops CM IDD	Update	1 - 2

Assumptions

This estimate is based on the assumption that the Checkpoint/Restart Thread will not need the capability to retrieve a Checkpoint while the Gateway is Operational.

Open Issues

No Checkpoints will be accessible when the Gateway is in Operational mode because FTP is disabled while the Gateway is Operational. Is it a problem for Ops CM to wait until the Gateway is in a Non-operational mode to retrieve the Checkpoints?

COTS Product Dependency List

None.

2.4 GSE GATEWAY SERVICES CSCI ASSESSMENT

GSE Gateway Services will require modification to provide the following functionality:
- Process the Checkpoint command including writing the current contents of all local tables to disk
- Process the Load Checkpoint command including reading the checkpoint tables from disk and restoring to memory.

Table Load CSC Work Required

This CSC will be modified to process both the Checkpoint and Load Checkpoint commands. The following tables will be checkpointed to or from local disk.
- Command/Measurement Data Table
- Poll Tables (1,10 and 100 Hz)
- Discrete Stimulus Table
- Discrete Measurement Table

CSCI Assessment

CSC Name	CSC Labor (LM)	% of CSC
Table Load	1.5	70 %

Basis of estimate

Estimated 200 lines of code to implement this functionality.

Documentation

Document Type	New/Update	Number of Pages
Requirements and Design Documentation	Update	2
Users Guide	Update	2
API Interface Document		

Document Type	New/Update	Number of Pages
Interface Design Document		
Test Procedure	Update	20

Assumptions

GSE Gateway Services checkpoint tables will only be written and read from the local disk. The tables will be read from the disk following the Checkpoint command or placed on the disk prior to the Load Checkpoint by another CSCI

The Load Checkpoint command will be executed <u>instead of</u> the Load TCID command, therefore table information contained in the original TCID must be stored even if it can not be changed by command.

This assessment **does not** include the capability to record commands (transaction log) and play them back to cover changes that occur between checkpoint commands. The estimate will roughly double if transaction log functionality is required.

Open Issues

None

COTS Product Dependency List

None

3.   SUBSYSTEM CHECKPOINT RESTART HWCI ASSESSMENTS

None.